IBJ
Indonesian Biodiversity Journal
http://ejurnal.unima.ac.id/index.php/ibj

indonesian.biodivers.j.
Vol. 5, No. 1, April 2024
ISSN : 2722-2659

THE ANTIOXIDANT ACTIVITY OF RED FRUIT EXTRACT (*Pandanus conoideus* L) FROM NABIRE PAPUA

Natalina Migau[1*], Mokosuli Yermia Semuel[2*], Masje Wurarah[2], Nonny Manampirng[2]

[1]Biology Masters Study Program, FMIPAK, Universitas Negeri Manado, Tondano, North Sulawesi, Indonesia.
[2]Department of Biology, FMIPAK, Universitas Negeri Manado, Tondano, North Sulawesi, Indonesia.

*Corresponding author: natalinamigau2023@gmail.com; labbiomolunima@gmail.com

Received: March 28, 2024 *Accepted: April 30, 2024*

Abstract

Red fruit (Pandanus conoideus Lam) is a native Papuan plant which has been used by indigenous Papuan people as a medicinal plant. Papuan people believe that red fruit has a broad spectrum of pharmacological activity. This research aims to obtain antioxidant activity, namely reducing DPPH free radicals from Papuan red fruit ethanol extract. Samples of red fruit obtained from Nabire Papua. After determination, the red fruit is extracted using the maceration method. The ethanol extract of red fruit was then used for the DPPH antioxidant test method. The results showed that the ethanol extract of red fruit contains phenolic compounds: flavonoids, tannins; and steroids in high intensity. Ethanol extract of red fruit has very strong antioxidant activity (46.99 ppm; R^2=0.99). Ethanol extract of Papuan red fruit has potential as a source of bioactive natural antioxidants.

Keywords: Red fruit, antioxidants, DPPH

INTRODUCTION

Papua Islands natives are known for their red fruit (Pandanus conoideus Lam), a monocotyledon plant. Nonetheless, red fruit is widely available in Papua New Guinea, Maluku, and Papua Indonesia (Gunawan et al., 2021). With a height of up to 16 meters and a stem height of 5 to 8 meters without branches, the red fruit plant belongs to the pandanus family of plants. has reticulate roots on the bottom stem. Oval-shaped fruit cultivars have fruit leaves covering their buds. The crimson fruit is 55 cm long, 10–15 cm in diameter, and weighs two to three kilograms each. Certain varieties of fruit plants are brown or yellowish brown when fully ripe, yet they are also blood red. According to Zebua and Walujo (2016), the red fruit is known as a drupe (length 1, 0–1.5 cm), which is made up of several solitary fruits that are arranged in a right triangle shape inside a cylindrical syncarp (length 86–110 cm and circumference 30-35 cm).

Originally from the Papua Islands, pandanus conoideus Lam is a monocot plant. On the other hand, Papua New Guinea, Indonesia, and Maluku are all major producers of red fruit (Gunawan et al., 2021).

indonesian.biodivers.j.
Vol. 5, No. 1, April 2024
ISSN : 2722-2659

With a plant height of up to 16 m and a stem height of 5 to 8 m without branches, the red fruit plant belongs to the pandan pandanan family under botanical criteria. has roots on the lower stem that provide support. The fruit leaves on fruit cultivars cover the oval-shaped buds. With a length of 55 cm and a diameter of 10-15 cm, each red fruit weighs 2-3 kilograms. Certain varieties of fruit plants are brown or yellowish brown when fully ripe, yet they are also blood red. According to Zebua and Walujo (2016), the red fruit is known as a drupe (length 1, 0–1.5 cm), which is made up of several solitary fruits that are arranged in a right triangle shape inside a cylindrical syncarp (length 86–110 cm and circumference 30-35 cm).

The Papuan people utilize red fruit as a coloring ingredient to give food and food products a vibrant red color. They also use the fruit as a source of vegetable oil and traditional medicines (Sadolona and Agustin, 2021). Furthermore, red fruit oil has been shown in animal models to have potential health benefits, including avoiding preeclampsia symptoms and enhancing spermatozoa quality (Sugiritama, 2023).

The active substances found in red fruit, specifically the tocopherols, carotenoids, and fatty acids, may be linked to this biological activity (Mokosuli et al., 2024). It is well recognized that red fruits are rich in carotenoid substances as α-carotene, ß-carotene, and ß-cryptoxanthin (6). Additionally, it contains decanoate, protein, calcium, vitamins, energy, fat, fiber, α-tocopherol, oleic acid, and linoleic acid (7). In this study, red fruit from Nabire, Papua, was utilized. Red fruit is traditionally consumed by Papuans, regardless of whether they reside in coastal or upland regions. For many years, the Papuan people have used it as food and as a natural food colouring, in addition to being a source of craft materials (Zebua and Walujo, 2016). In comparison to groups in other parts of the Jayawijaya mountain region, traditional communities living in Wamena and Tolikara, and who consume red fruit as a daily meal element, have a stockier and stronger body posture. Although there are currently very few reports of red fruit being used for diabetes mellitus, the indigenous people of Papua have long used red fruit as food and medicine.

Naturally occurring and synthesised antioxidant molecules can regulate blood glucose and avert more serious effects from diabetes (Unuofin and Lebelo, 2020). Numerous bioactive substances with antioxidant qualities have been found, including coumarins, diterpenes, flavonoids, polypropanoids, tannins, and triterpenes. The majority of the plant is composed of these bioactive substances. According to Wulansari et al. (2020) and Mokosuli et al. (2024), red fruit has high concentrations of various active compounds, such as total carotenoids (12,000 ppm), total tocopherol (11,000 ppm), beta-carotene (700 ppm), α-tocopherol (500 ppm), and fatty acids like oleic acid (58%), linoleic acid (8.8%), linolenic acid (7.8%), and decanoic acid (2.0%).

Red fruit (Pandanus conoideus Lam.) ethanol extract provides 1,392x10–3g ATE/g extract of antioxidant potential (Wabula et al., 2019). There hasn't been much research published on red fruit extract's decreasing ability to neutralise DPPH free radicals. Furthermore, red fruit originates in Papua's Nabire highlands. The potential of red fruit as an antioxidant and for other therapeutic purposes, such as antidiabetes, anticancer, antiglycemia, and antihyperlipidemia, will be described by its capacity to decrease DPPH free radicals.

indonesian.biodivers.j.
Vol. 5, No. 1, April 2024
ISSN : 2722-2659

RESEARCH METHODS

Samples

Red fruit samples were obtained from Nabire Papua. The description of the red fruit was carried out in the FMIPAK Unima Biology Laboratory. Antioxidant tests were carried out in the FMIPAK Unima biomolecular and bioactivity laboratory. Compound content analysis was carried out in the biology laboratory and the Central Laboratory of Unpad Bandung.

Red Fruit Extraction

Red Fruit was tested at the Unima Biological Laboratory after being taken from the Papua region. The aim of the plant determination test is to determine the identity of a plant, or whether it is a desired plant. To avoid errors in collecting the material to be studied, the plants are washed with water until clean, chopped into small pieces, dried, and then blended. The extraction process is carried out using ready-made powder. Extraction is carried out using the maceration method. A total of 500 grams of red fruit was mixed with 3000 mL of ethanol. In a place protected from light and at room temperature, the mixture is left for 2 x 24 hours, stirring occasionally. The liquid resulting from the maceration process is then filtered. The filtrate was then concentrated using a Heidolp Rotary Evaporator at a temperature of 55 0 C, 40 rpm.

DPPH Antioxidant Test method

Red fruit ethanol extract was made in various concentrations (10, 50, 100, 200, and 250 ppm). Each is put into a test tube. To each reaction tube was added 500 µl of 1 mM DPPH solution in methanol. The volume was made up to 5.0 ml, then incubated at 37oC for 30 minutes; then, the absorbance was measured at a wavelength of 515 nm. As a positive control and comparison, vitamin C (concentrations 2, 3, 4, and 5 ppm) and Vitamin C (concentrations 2, 4, 6, and 8 ppm) were used. The IC50 value is calculated using the regression equation formula respectively (Mokosuli, 2008; Semuel et al, 2019).

$$\%\ \text{Scavenging} = \frac{[\ \text{DPPH Absorbance} - \text{The absorbance of the test sample}\ ]}{[\ \text{DPPH Absrobance}\ ]} \text{x } 100\ \%$$

LC_{50} determination was carried out using probit analysis on IBM SPSS 23.

RESULTS AND DISCUSSION

The maceration process was used to extract red fruit. Comparing simplicia with solvent (1:4 w/v). 1000 millilitres of 95% ethanol were used to macerate 250 grammes of red fruit simplicia. The fluid turned blood red after 48 hours. After filtering, a thick, dark red filtrate with a pronounced aroma of red fruit is obtained. A dark crimson crude extract with a distinct red fruit scent is produced when the solvent is evaporated using a rotary evaporator. The extract made of 95% ethanol has a gel-like consistency (Figure 1). A total weight of 91.18 grammes was obtained from the extraction of red fruit simplicia. Therefore, 36.47% is the yield percentage.

indonesian.biodivers.j.
Vol. 5, No. 1, April 2024
ISSN : 2722-2659

Figure 1. Papuan red fruit extract

Antioxidant Activity

Red fruit ethanol extract demonstrated the strongest inhibitory power, with an average of 83.50%, at a test concentration of 78.6 ppm. At a test dosage of 15.7 ppm, or 21.14%, the lowest average inhibitory power for DPPH free radicals was observed (Table 1).

Table 1. Inhibitory power of red fruit extract against DPPH free radicals.

No.	Concentration (ppm)	Absorbance		% inhibition	
		Test 1	Test 2	Test 1	Test 2
1.	0	0.8791	0.8791	0.0000	0.0000
2.	15.7	0.6936	0.6930	21.1011	21.1694
3.	31.4	0.6116	0.6110	30.4288	30.4971
4.	47.2	0.4091	0.4085	53.4638	53.5320
5.	62.9	0.3206	0.3200	63.5309	63.5991
6.	78.6	0.1456	0.1444	83.4376	83.5741

The LC50 of red fruit ethanol extract against DPPH free radicals was 46.99 ppm (R2=0.99), according to the regression analysis results. Based on the LC50 value being less than 100 ppm, red fruit extract's DPPH free radical lowering activity is categorised as strong (Figure 2). The linear regression equation, Y = 1.0325x + 1.4766, was derived from the regression curve, and for the red fruit ethanol extract sample, the r value was 0.99. The obtained R-value data indicates that the red fruit extract probit data is nearly equal to 1, indicating an excellent value.

Flavonoid, phenolic, steroid, and tannin components are present in high concentrations in the red fruit ethanol extract, according to the results of the bioactive analysis. Methyl palmitate, methyl oleate, methyl stearate, ethyl palmitate, ethyl oleate, aldehyde, and carboxylic group-containing aliphatic chain cyclopentane are among the compounds found in the GC MS analysis results of red fruit ethanol extract (Mokosuli et al., 2024). When a compound's IC50 value is less than 50 mg/L, it is considered very strong; when it is between 50 and 100 mg/L, it is considered strong; when it is between 101 and 150 mg/L, it is considered moderate; and when it is between 151-200 mg/L, it is considered very weak (Molyneux, 2003). Additionally, compounds that are classified as strong have antioxidant activity. The antioxidant test and DPPH technique results suggest that red fruit extract may contain bioactive antioxidants.

indonesian.biodivers.j.
Vol. 5, No. 1, April 2024
ISSN : 2722-2659

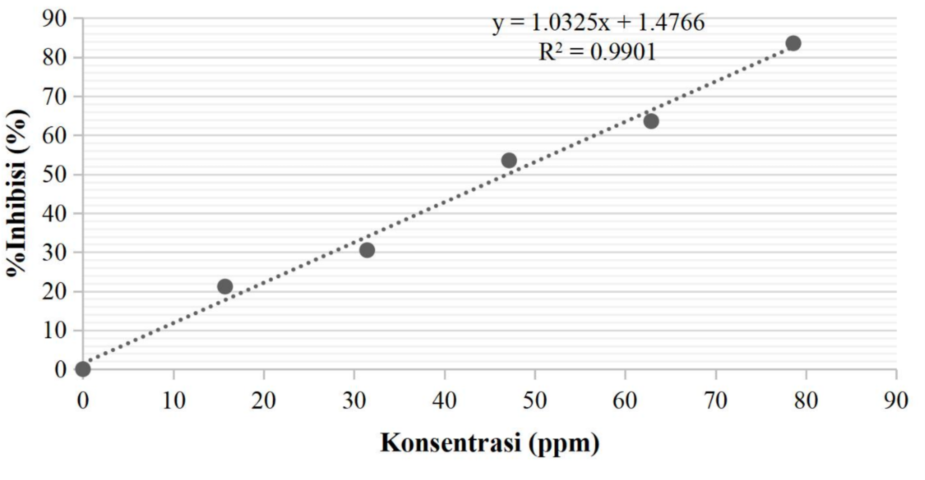

Figure 2. Antioxidant activity diagram (DPPH) of red fruit ethanol extract.

Antioxidants are described as compounds that, even at low concentrations, can greatly slow down or stop the oxidation of substrate molecules (Gulcin et al., 2010; Gulcin and Alwasel, 2023). By lowering oxidative damage in biological processes and giving free radicals electrons, they neutralise them and render them harmless (Shantabi et al., 2014). By interfering with the oxidative process mediated by free radicals at any moment throughout its three main stages (initiation, propagation, and termination), antioxidants prevent the generation of free radicals (Kedare and Sing, 2011). The effectiveness of an antioxidant chemical is influenced by many factors. The most important variables include the system's physical condition, temperature, structural features, the oxidation-sensitive substrate's properties, concentration, synergistic effect, and the presence of pro-oxidant chemicals (Lourence et al., 2019). Using DPPH, a stable free radical, the technique for measuring antioxidant activity was created. According to Kokosuli (2008) and Gulcin and Alwasel (2023), Goldschmidt and Renn made the discovery of the 1,1-diphenyl-2-picrylhydrazil (DPPH) radical in 1922. In Figure 3, the 1,1-diphenyl-2-picrylhydrazil radical's (DPPH) molecular structures are displayed.

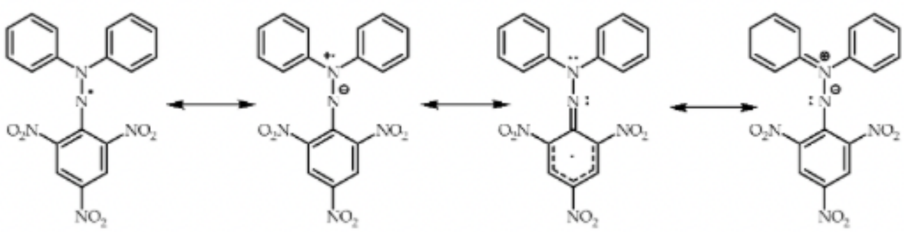

Figure 3. The chemical structures of a 1,1-diphenyl-2-picrylhydrazil radical (DPPH·).

The ethanol extract from red fruits has a large amount of phenolic compounds. The potential antioxidant mechanism is due to the red fruit extract's higher content of phenolic components. Due to its application in lowering the oxidation rate of organic materials exposed to airborne molecular oxygen, this phenolic compound-mediated radical scavenging method has significant industrial and biological

indonesian.biodivers.j.
Vol. 5, No. 1, April 2024
ISSN : 2722-2659

significance (Foti, 2007). Peroxyl and DPPH radicals have extremely quick reactions, which makes monitoring them challenging and necessitates the use of specialised equipment. Lebeau (2020) claims that compared to ROOS, the coloured DPPH· radical is significantly less reactive and easier to access.

An excellent illustration of this is the interaction of the H-donor phenolic molecule quercetin with the DPPH radical. A regular diet should include quercetin, a flavonoid that is primarily found in plants (Conquer et al. 1998; Gulcin and Alwasel, 2023). This polyphenolic component is best represented by the overall flavonoid content of plant extracts. Quinomethide/quinone is a brightly coloured chemical that is produced when quercetin undergoes a two-electron oxidation (Figure 4). Quercetin exists in a variety of tautomeric forms in solution; reports suggest that the most stable and prevalent form is the second tautomeric form shown in Figure 5. These compounds' peculiar colours and UV-vis spectra, which resemble those of the

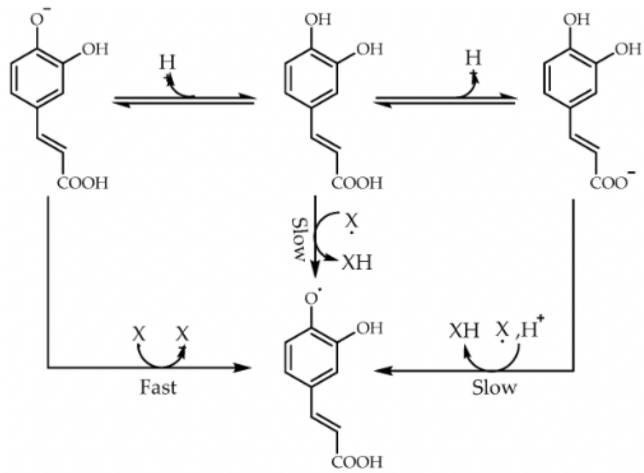

Figure 4. The mechanism between cinnamic acids and 1,1-diphenyl-2-picrylhydrazil (DPPH·) radicals.

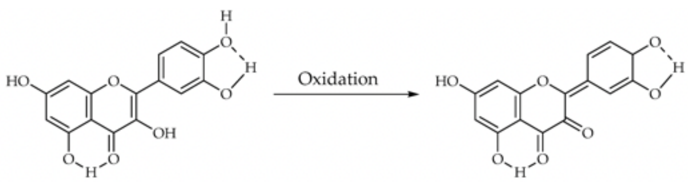

Figure 5. Enol and keto tautomeric forms of a quercetin molecule.

For antioxidant profiles, the ability of the compounds used for this purpose to scavenge DPPH radicals can be particularly advantageous. The removal of DPPH radicals is a widely employed technology in the food and pharmaceutical industries.

CONCLUSION

Ethanol extract of Papuan red fruit has potential as a source of bioactive natural antioxidants. The DPPH free radical reducing activity of red fruit ethanol extract is classified as very strong.

ACKNOWLEDGMENT

Thank you to those in Nabire who have helped procure red fruit samples. Thank you to the Biology

Laboratory, Bioactivity and Molecular Biology sub-laboratory, FMIPAK Unima, which has helped carry out this research. This research is part of the master's thesis research at the FMIPAK Biology Master's Study Program, Manado State University

REFERENCES

Conquer, J.A.; Maiani, G.; Azzini, E.; Raguzzini, A.; Holub, B.J. (1998). Supplementation with quercetin markedly increases plasma quercetin concentration without effect on selected risk factors for heart disease in healthy subjects. *J. Nutr. 128*, 593–597.

Foti, M.C. (2017). Antioxidant properties of phenols. *J. Pharm. Pharmacol. 59*, 1673–1685.

Gulcin, I.; Elias, R.; Gepdiremen, A.; Chea, A.; Topal, F. (2010). Antioxidant activity of bisbenzylisoquinoline alkaloids from *Stephania rotunda*: Cepharanthine and fangchinoline. *J. Enzym. Inhib. Med. Chem. 25*, 44–53.

Gulcin, İ.; Alwasel, S.H. (2023). DPPH Radical Scavenging Assay. *Processes 11*, 2248. https://doi.org/10.3390/pr11082248

Gunawan, I. A., Fujii, R., Maoka, T., Shioi, Y., Kameubun, K. M. B., Limantara, L., & Brotosudarmo, T. H. P. (2021). Carotenoid composition in buah merah (Pandanus conoideus Lam.), an indigenous red fruit of the Papua Islands. Journal of Food Composition and Analysis, 96, 103722.

Kedare, S.B.; Sing, R.P. (2011). Genesis and development of DPPH method of antioxidant assay. *J. Food Sci. Technol*, *48*, 412–422.

Lourenco, S.C.; Moldao-Martins, M.; Alves, V.D. (2019). Antioxidants of natural plant origins: From sources to food industry applications. *Molecules*. *24*, 4132.

Lebeau, J.; Furman, C.; Bernier, J.L.; Duriez, P.; Teissier, E.; Cotelle, N. (2020). Antioxidant properties of di-tert-butylhydroxylated flavonoids. *Free Radic. Biol. Med. 29*, 900–912.

Mokosuli, Y. S., Migau, N., & Wurarah, M. (2024). Bioactivity of Papua Red Fruit Extract (Pandanus conoideus L.) Against Superoxide dismutase, Malondialdehyde and Blood Glucose of Rat (Rattus norvegicus L.) Hyperglycemia. *Molekul, 19(1),* 86-97.

Molyneux, P. (2003). The use of the stable free radical diphenylpicrylhydrazyl (dpph) for estimating antioxidant activity. *Journal of Science and Technology, 26*(2), 211-219.

Sadolona, E., & Agustin, R. (2021). Pengaruh penambahan minyak buah merah terhadap kualitas organoleptik nugget ayam. *Jurnal AgroSainTa: Widyaiswara Mandiri Membangun Bangsa, 5(2),* 77-84.

Semuel, M. Y., Kaunang, E. S. N., & Manopo, J. S. (2019). The bioactive contents and antioxidant activity of honey bee nest extract of Apis dorsata Binghami from the North Sulawesi. *Molekul, 14(2),* 92-102.

Sugiritama, I. W. (2023). Potensi Minyak Buah Merah sebagai Antioksidan dalam Mencegah Gejala Preeklampsia. Deepublish.

Shantabi, L.; Jagetia, G.C.; Ali, M.A.; Singh, T.T.; Devi, S.V. (2014). Antioxidant potential of *Croton caudatus* leaf extract in vitro. *Transl. Med. Biotechnol*, *2*, 1–15.

Unuofin, J. O., & Lebelo, S. L. (2020). Antioxidant effects and mechanisms of medicinal plants and their bioactive compounds for the prevention and treatment of type 2 diabetes: an updated review. Oxidative medicine and cellular longevity,

Wabula RA, Seniwati S, Widiastuti H. (2019). Aktivitas Antioksidan Ekstrak Etanol Buah Merah (Pandanus conoideus Lam.) dengan Metode Ferric Reducing Antioxidant Power (FRAP). *Window of Health, 2(4)*, 329-37.

Wulansari, D., Wawo, A. H., & Agusta, A. (2020). Carotenoid content of five accessions red fruit (Pandanus conoideus Lam.) oil. In IOP Conference Series: Earth and Environmental Science 591(1), p.012033.

Zebua, L. I., & Walujo, E. B. (2016). Pengetahuan tradisional Masyarakat Papua Dalam Mengenali, Mengklasifikasi dan Memanfaatkan Pandan Buah Merah (Pandanus conoideus Lam). *Jurnal Biologi Papua, 8(1),* 23-37.